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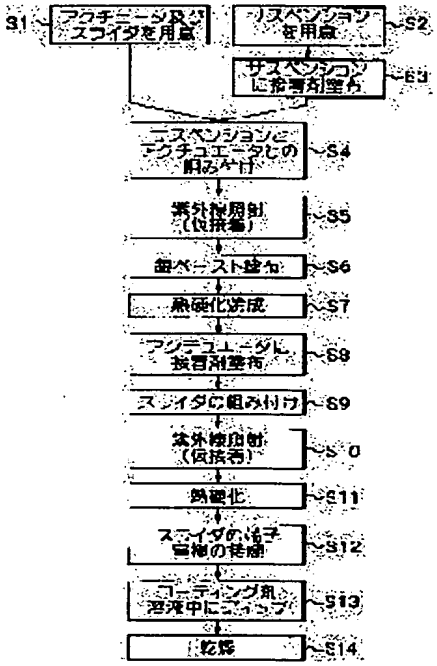
(54) HEAD GIMBALS ASSEMBLY EQUIPPED WITH ACTUATOR FOR FINE POSITIONING, DISK DEVICE EQUIPPED WITH HEAD GIMBALS ASSEMBLY, AND MANUFACTURING METHOD FOR HEAD GIMBALS ASSEMBLY

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an HGA(head gimbals assembly) equipped with an actuator for fine positioning which prevents the grain drop of a piezoelectric material, does not impede the operation of the actuator, can be manufactured by a simplified process, and does not lower the strength of adhesion of the actuator, and to provide a disk device equipped with this HGA, and a method for manufacturing this HGA.
SOLUTION: A head slider having at least one head element is fixed on the actuator that uses a piezoelectric phenomena to perform the fine positioning of a head element. After fixing this actuator on a supporting mechanism to form the HGA, a coating film is deposited on the whole HGA by applying a low surface energy coating agent, for example, a fluorine system coating agent.



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CLAIMS

[Claim(s)]
[Claim 1] The head gimbal assembly which is equipped with the head slider which has at least one head element, the actuator using the piezoelectric phenomena which this head slider has fixed and performs minute positioning of the aforementioned head element, and the support mechanism for this actuator having fixed and supporting this actuator, and was equipped with the actuator for minute positioning characterized by covering the whole by the covering film by the low surface energy coating agent.
[Claim 2] The head gimbal assembly according to claim 1 characterized by to have the displacement generating arm section to which the aforementioned actuator connects the fixed part formed in one edge, the moving part formed in the other-end section, this fixed part, and moving part, for the aforementioned support mechanism to have fixed to the aforementioned fixed part in one field of the aforementioned actuator, and for the aforementioned head slider to have fixed to the aforementioned moving part in the field of another side of the aforementioned actuator.
[Claim 3] The head gimbal assembly according to claim 1 characterized by for the aforementioned actuator having projected from the base which has fixed in the aforementioned support mechanism, and this base, equipping it with one pair of movable arm sections which can be displaced according to the driving signal, and ****(ing) the aforementioned head slider between these movable arm sections.
[Claim 4] A head gimbal assembly given in any 1 term of the claims 1-3 characterized by the aforementioned low surface energy coating agent being a fluorine system coating agent.
[Claim 5] A head gimbal assembly given in any 1 term of the claims 1-4 characterized by the thickness of the aforementioned covering film being 1.8nm or less.
[Claim 6] The head gimbal assembly according to claim 5 characterized by the thickness of the aforementioned covering film being 1.2nm or less.
[Claim 7] A head gimbal assembly given in any 1 term of the claims 1-6 characterized by the aforementioned head element being a thin film magnetic-head element.
[Claim 8] The disk unit characterized by equipping any 1 term of claims 1-7 with at least one head gimbal assembly of a publication.
[Claim 9] The manufacture method of the head gimbal assembly characterized by forming the covering film by the low surface energy coating agent in this whole head gimbal assembly after fixing in a support mechanism through the actuator using the piezoelectric phenomena which performs minute positioning of this head element for the head slider which has at least one head element and forming a head gimbal assembly.
[Claim 10] It has the displacement generating arm section which connects the fixed part formed in one edge, the moving part formed in the other-end section, this fixed part, and moving part. The actuator using the piezoelectric phenomena which performs minute positioning of a head element is prepared. After fixing to the aforementioned moving part of the aforementioned actuator which fixed the aforementioned fixed part of this actuator in the support mechanism, and fixed the head slider which has at least one head element in this support mechanism and forming a head gimbal assembly, The manufacture method of the head gimbal assembly

characterized by forming the covering film by the low surface energy coating agent in this whole head gimbal assembly.
[Claim 11] The actuator for head element minute positioning equipped with one pair of movable arm sections which can be displaced according to the driving signal is prepared. The head slider which has at least one head element between the aforementioned movable arm sections of this actuator is ****(ed). The manufacture method of the head gimbal assembly characterized by forming the covering film by the low surface energy coating agent in this whole head gimbal assembly after fixing the aforementioned actuator which attached this head slider in a support mechanism and forming a head gimbal assembly.
[Claim 12] The manufacture method given in any 1 term of the claims 9-11 characterized by for formation of the aforementioned covering film drying the aforementioned head gimbal assembly after being immersed in a low surface energy coating agent solution, and performing it.
[Claim 13] The manufacture method given in any 1 term of the claims 9-12 characterized by the aforementioned low surface energy coating agent being a fluorine system coating agent.
[Claim 14] The manufacture method given in any 1 term of the claims 9-13 characterized by setting thickness of the aforementioned covering film to 1.8nm or less.
[Claim 15] The manufacture method according to claim 14 characterized by setting thickness of the aforementioned covering film to 1.2nm or less.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the head gimbal assembly (HGA) equipped with the actuator for minute positioning of head elements, such as a thin film magnetic-head element or an optical head element, the disk unit equipped with this HGA, and this manufacture method of HGA.
[0002]
[Description of the Prior Art] In a magnetic disk unit, the magnetic-head slider attached in the point of the suspension of HGA is surfaced from the front face of the rotating magnetic disk, and record to a magnetic disk and/or reproduction from a magnetic disk are performed by the thin film magnetic-head element carried in this magnetic-head slider in the state.
[0003] large-capacity-izing and the formation of high-density record of recent years and a magnetic disk unit -- following -- the densification of disk radial (the direction of the width of recording track) density -- progressing -- **** -- the former -- the time -- a voice coil motor (Following VCM is called) -- depending -- control -- **** -- the magnetic head -- it is becoming difficult to double a position correctly
[0004] It is the technology in which the actuator performs detailed precision positioning which being proposed as one of the meanses which realizes precision positioning of the magnetic head carries another actuator mechanism in a magnetic-head slider side further, and it cannot follow by VCM from the conventional VCM (for example, refer to JP,6-259905,A, JP,6-309822,A, and JP,8-180623,A).
[0005]
[Problem(s) to be Solved by the Invention] When this kind using the piezoelectric device of actuator is used, there is a problem (it degrains) of which the particle of a piezoelectric device drops out. That is, since the piezoelectric material itself is a brittle material, even if it is in an anticipated-use state, grain boundaries, such as a crystal, exfoliate by prolonged operation, and it becomes easy to generate degraining highly [the probability that the own chip and own crack of an element will occur]. Any degraining is not allowed in this kind arranged on a magnetic disk of actuator.
[0006] It is difficult for such a piezoelectric material to change the own property of a material so that degraining may decrease. For this reason, these people have already proposed the technology of aiming at degraining prevention, by coating on the surface of an actuator (Japanese Patent Application No. No. 296597 [11 to]).
[0007] Generally, in HGA equipped with the actuator, in order not to check the movement of an actuator, it is necessary to keep and assemble a gap between an actuator and a suspension between a magnetic-head slider and an actuator depending on the case. However, if it coats on the surface of an actuator, such a gap is lost, friction will arise between a magnetic-head slider and an actuator and/or between an actuator and a suspension, the stroke (variation rate) of an actuator will fall, and the movement of a slider will be checked.
[0008] Furthermore, if it coats, it will become difficult to maintain the bond strength in the coating side, and on-the-strength degradation will surely arise.

[0009] Therefore, this invention cancels the trouble which the conventional technology mentioned above, and the purpose is in offering HGA equipped with the actuator for minute positioning which can prevent degraining certainly, the disk unit equipped with this HGA, and this manufacture method of HGA, when piezoelectric material is used.
[0010] Other purposes of this invention are to offer HGA equipped with the actuator for minute positioning which can moreover simplify a manufacturing process, the disk unit equipped with this HGA, and this manufacture method of HGA, without checking the variation rate of an actuator.
[0011] The purpose of further others of this invention is to offer HGA equipped with the actuator for minute positioning without the fall of the bond strength of an actuator, the disk unit equipped with this HGA, and this manufacture method of HGA.
[0012]
[Means for Solving the Problem] The head slider which has at least one head element according to this invention, The actuator using the piezoelectric phenomena which this head slider has fixed and performs minute positioning of a head element, It has the support mechanism for this actuator having fixed and supporting an actuator. The disk unit equipped with HGA and at least one HGA equipped with the actuator for minute positioning covered by the covering film by the low surface energy coating agent whose whole is for example, a fluorine system coating agent is offered.
[0013] After fixing in a support mechanism through the actuator using the piezoelectric phenomena which performs minute positioning of a head element for the head slider which has at least one head element and forming HGA according to this invention furthermore, the manufacture method of HGA which forms in this whole HGA the covering film by the low surface energy coating agent which is for example, a fluorine system coating agent is offered.
[0014] Furthermore, according to this invention, it has the displacement generating arm section which connects the fixed part formed in one edge, the moving part formed in the other-end section, these fixed parts, and moving part. The actuator using the piezoelectric phenomena which performs minute positioning of a head element is prepared. After fixing to the moving part of the actuator which fixed the fixed part of this actuator in the support mechanism, and fixed the head slider which has at least one head element in the support mechanism and forming HGA, The manufacture method of HGA which forms in this whole HGA the covering film by the low surface energy coating agent which is for example, a fluorine system coating agent is offered.
[0015] Furthermore, according to this invention, the actuator for head element minute positioning equipped with one pair of movable arm sections which can be displaced according to the driving signal is prepared. The head slider which has at least one head element between the movable arm sections of this actuator is ****(ed). After fixing the actuator which attached the head slider in a support mechanism and forming HGA, the manufacture method of HGA which forms in this whole HGA the covering film by the low surface energy coating agent which is for example, a fluorine system coating agent is offered.
[0016] Since the whole HGA is covered by the covering film by the low surface energy coating agent which is for example, a fluorine system coating agent and all the piezoelectric-material portions of an actuator will also be covered, degraining becomes that there is nothing. Since a low surface energy coating agent has ******, the migration by water absorption of a coating agent does not produce it under the environment of high temperature and high humidity.
[0017] Moreover, since it is covered to the electrode-terminal section of not only piezoelectric material but an actuator and a head slider, improvement in reliability of connection can also be aimed at. In addition, since the surfacing side (ABS) of a head slider is also covered simultaneously, contamination adhesion in ABS can also be prevented.
[0018] Furthermore, since the covering film by the low surface energy coating agent which is for example, a fluorine system coating agent is formed in this whole HGA after forming HGA (i.e., since it has coated after adhesion), a bond strength does not fall.
[0019] It is desirable that have the displacement generating arm section to which an actuator connects the fixed part formed in one edge, the moving part formed in the other-end section, these fixed parts, and moving part, the support mechanism has fixed to the fixed part in one field of an actuator, and the head slider has fixed to the moving part in the field of another side of an

actuator.
[0020] The actuator has projected from the base which has fixed in the support mechanism, and the base, and is equipped with one pair of movable arm sections which can be displaced according to the driving signal, and it is also desirable that the head slider is ****(ed) between the movable arm sections.
[0021] It is desirable that the thickness of a covering film is 1.8nm or less, and it is more desirable that it is 1.2nm or less. by boiling the thickness of a covering film to this extent, and controlling it, it is lost that the stroke (variation rate) of an actuator does not fall and the movement of a head slider is checked
[0022] It is desirable that a head element is also a thin film magnetic-head element.
[0023] It is desirable that formation of a covering film dries HGA after being immersed in the low surface energy coating agent solution which is for example, a fluorine system coating agent, and it is performed. Thus, since the covering film is formed in the whole HGA by being immersed and thin layer coating can be performed, without filling the gap between each part material of HGA, operation of an actuator is not checked. And since coating of HGA can be performed only in being immersed, a manufacturing process can be simplified sharply.
[0024]
[Embodiments of the Invention] Drawing 1 is the perspective diagram showing the composition of the important section of a magnetic disk unit roughly as 1 operation gestalt of this invention, drawing 2 is the plan which looked at the whole head gimbal assembly (HGA) in the operation gestalt of drawing 1 from the slider side, and drawing 3 is the decomposition perspective diagram showing the installation structure to FUREKUSHA of the actuator in the operation gestalt of drawing 1 , and a magnetic-head slider. In addition, this operation gestalt is the case where what is called piggyback structure is used as an actuator.
[0025] In drawing 1 , two or more magnetic disks with which 10 rotates the surroundings of a shaft 11, and 12 show the assembly carriage equipment for positioning a magnetic-head slider on a truck, respectively. Assembly carriage equipment 12 mainly consists of carriage 14 in which angle rocking is possible, and a main actuator 15 which carries out the angle rocking drive of this carriage 14 and which consists of a voice coil motor (VCM), for example centering on the shaft 13.
[0026] The base of two or more drive arms 16 by which the stack was carried out is attached in the direction of a shaft 13 at carriage 14, and HGA17 has fixed to the point of each drive arm 16. Each HGA17 is formed in the point of the drive arm 16 so that the magnetic-head slider formed in the point may counter to the front face of each magnetic disk 10.
[0027] As shown in drawing 2 and drawing 3 , HGA attaches the actuator 22 for performing precision positioning of a magnetic-head element to the point of a suspension 20, fixes the slider 21 which has a magnetic-head element in the actuator 22, and is constituted.
[0028] The main actuator 15 shown in drawing 1 is formed in order to carry out the variation rate of the drive arm 16 which attached HGA17 and to move the whole assembly, and with such a main actuator 15, the actuator 22 is formed in order to make possible the detailed variation rate which cannot be driven.
[0029] The suspension 20 mainly consists of FUREKUSHA 26 which has the elasticity which supports a slider 21 through an actuator 22, a load beam 23 with which support fixing of FUREKUSHA 26 is carried out, and this also has elasticity, and a base plate 27 formed in the base of the load beam 23, as shown in drawing 2 and drawing 3 .
[0030] FUREKUSHA 26 has soft tongue 26a pressed by the dimple prepared in the load beam 23 at one edge, and has the elasticity which supports a slider 21 flexibly through an actuator 22 by this tongue 26a. Like this operation form, the rigidity of FUREKUSHA 26 is lower than the rigidity of the load beam 23 by the suspension of 3 piece structures where FUREKUSHA 26 and the load beam 23 became independent which are parts.
[0031] FUREKUSHA 26 is constituted from this operation gestalt by the stainless steel plate (for example, SUS304TA) with a thickness of about 25 micrometers.
[0032] The load beam 23 consists of stainless steel plates which have the elasticity of about 60-65-micrometer ** of the configuration to which width of face becomes narrow towards a nose of

cam, and is supporting FUREKUSHA 26 over the overall length. However, fixing with FUREKUSHA 26 and the load beam 23 is made by pinpoint fixing with two or more welding points.

[0033] The base plate 27 consists of stainless steel or iron, and has fixed by welding to the base of the load beam 23. By attaching this base plate 27 and fixing by section 27a, installation to the drive arm 16 (drawing 1) of a suspension 20 is performed. In addition, FUREKUSHA 26 and the load beam 23 are not formed separately, but it is good also as a suspension of 2 piece structures of a base plate and a flakes shear load beam.

[0034] two or more leads depended on a laminating thin film pattern on FUREKUSHA 26 -- the flexible wiring containing a conductor -- the member 28 is formed namely, wiring -- the member 28 is formed on the sheet metal like the flakes SHIBURU printed circuit (Flexible Print Circuit, FPC) by the same well-known patterning method as creating a printed circuit board For example, it is formed by carrying out the laminating of the 2nd insulating material layer by resin material, such as a polyimide with an insulating material layer [by resin material, such as a polyimide with a thickness of about 5 micrometers, / 1st], a Cu layer (lead conductor layer) of with a thickness of about 4 micrometers patternized, and a thickness of about 5 micrometers, one by one from a FUREKUSHA 26 side in this sequence. However, as for the portion of the connection pad for connecting with a magnetic-head element and an external circuit, laminating formation of the Au layer is carried out on Cu layer, and the insulating material layer is not formed on it.

[0035] this operation gestalt -- setting -- this wiring -- two one side and the both sides by which a member 28 is connected to a magnetic-head element -- the lead of a total of four -- the 1st wiring containing a conductor -- a member -- 28a, and two one side and the both sides which are connected to an actuator 22 -- the lead of a total of four -- the 2nd wiring containing a conductor -- it consists of member 28b

[0036] the 1st wiring -- a member -- the lead of 28a -- the end of a conductor is connected to the connection pad 29 for magnetic-head elements prepared in the point of FUREKUSHA 26 The connection pad 29 is connected to the terminal electrode of the magnetic-head slider 21 by golden bonding, wirebonding, or stitch bonding. the 1st wiring -- a member -- the lead of 28a -- the other end of a conductor is connected to the connection pad 30 for external circuits for connecting with an external circuit

[0037] the 2nd wiring -- a member -- the lead of 28b -- the end of a conductor is connected to the connection pad for actuators (with no illustration) formed in tongue 26a of FUREKUSHA 26, and this connection pad is connected to the terminal electrode of an actuator 22 the 2nd wiring -- a member -- the lead of 28b -- the other end of a conductor is connected to the connection pad 30 for external circuits for connecting with an external circuit

[0038] An actuator 22 has fixed part 22a and moving-part 22b, and has further the cylindrical two displacement generating arm sections 22c and 22d which connect these. Piezo-electricity and at least one layer of electrostriction material layers in which an electrode layer exists are prepared in both sides at the displacement generating arm sections 22c and 22d, and it has the composition of generating expansion and contraction, by impressing voltage to an electrode layer. Piezo-electricity and an electrostriction material layer consist of piezo-electricity and electrostriction material expanded and contracted by the inverse piezoelectric effect or the electrostrictive effect. Three terminal electrodes connected to the above-mentioned electrode layer are formed in fixed part 22a.

[0039] As shown in drawing 3 , the upper surface in fixed part 22a of an actuator 22 has pasted tongue 26a of FUREKUSHA 26 with adhesives. Moving-part 22b of an actuator 22 has fixed, when a root face pastes predetermined section 22a by the side of the back end of the magnetic-head slider 21 (formation one end of magnetic-head element 21b) with adhesives.

[0040] Thus, a displacement generating arm sections [22c and 22d] end is connected with FUREKUSHA 26 through fixed part 22a, and the displacement generating arm sections [22c and 22d] other end is connected with the slider 21 through moving-part 22b. Therefore, a slider 21 displaces by expansion and contraction of the displacement generating arm sections 22c and 22d, and it displaces to an arc so that a magnetic-head element may intersect the recording track of a magnetic disk.

[0041] When the piezo-electricity and the electrostriction material layer in the displacement generating arm sections 22c and 22d consist of so-called piezoelectric material, such as PZT, polarization processing for the improvement in variability ability is usually performed to this piezo-electricity and electrostriction material layer. The direction of polarization by this polarization processing is the thickness direction of an actuator 22. When the sense of the electric field when impressing voltage to an electrode layer is in agreement with the direction of polarization, it elongates in the thickness direction (piezo-electric longitudinal effect), and the piezo-electricity and electrostriction material layer between two electrodes are contracted by the field inboard (piezo-electric transversal effect). On the other hand, when the sense of electric field is contrary to the direction of polarization, it contracts in the thickness direction (piezo-electric longitudinal effect), and piezo-electricity and an electrostriction material layer are elongated by the field inboard (piezo-electric transversal effect). and one variation rate -- the variation rate of the generating arm section and another side -- if the voltage which makes the generating arm section produce contraction is impressed by turns -- one variation rate -- the length of the generating arm section, and the variation rate of another side -- a ratio with the length of the generating arm section -- changing -- this -- both -- a variation rate -- the generating arm section bends in this direction in the field of an actuator 22 By this bending, moving-part 22b will rock in the direction of the arrow 31 of drawing 3 to fixed part 22a by making the position at the time of no voltage impressing into a center. This rocking is a variation rate to which moving-part 22b draws arc-shaped tracing in the direction which intersects perpendicularly mostly to the displacement generating arm sections [22c and 22d] flexible direction, and the rocking direction exists in the field of an actuator. Therefore, a magnetic-head element will also draw and rock arc-shaped tracing. Since voltage and polarization have the the same sense at this time, there is no fear of polarization attenuation and it is desirable. In addition, even if the voltage impressed to both the displacement generating arm section by turns expands the displacement generating arm section, the same rocking arises.

[0042] As an actuator 22, you may impress simultaneously voltage which a reverse variation rate produces mutually to both the displacement generating arm section. That is, when another side contracts in them when one side develops in one displacement generating arm section and the displacement generating arm section of another side, and one side contracts in them, you may impress simultaneously police box voltage which another side elongates. Rocking of moving-part 22b at this time makes a center the position at the time of no voltage impressing. In this case, the amplitude of rocking when making driver voltage the same becomes the twice [about] in the case of impressing voltage by turns. However, in this case, by one rocking side, the displacement generating arm section is made elongated and the driver voltage at this time becomes contrary to the sense of polarization. For this reason, when applied voltage is high, in performing voltage impression continuously, there is a possibility that polarization of piezo-electricity and electrostriction material may decline. Therefore, it is made for a bird clapper not to have the sense of driver voltage in the sense and reverse of polarization by applying fixed direct-current bias voltage to polarization and the same direction, and making into driver voltage what superimposed the aforementioned police box voltage on this bias voltage. Rocking in this case makes the position when impressing only bias voltage a center.

[0043] In addition, piezo-electricity and electrostriction material mean the material expanded and contracted by the inverse piezoelectric effect or the electrostrictive effect. Although piezo-electricity and electrostriction material may be anything as long as it is a material applicable to the displacement generating arm section of an actuator which was mentioned above, its ceramic piezo-electricity and electrostriction material, such as PZT [Pb(Zr, Ti) O3], PT (PbTiO3), PLZT [(Pb, La) (Zr, Ti)O3], and a barium titanate (BaTiO3), are usually desirable from rigidity being high.

[0044] Although the important point is not shown in drawing in this operation gestalt, the whole HGA is covered by the covering film by the low surface energy coating agent which is for example, a fluorine system coating agent. As a fluorine system coating agent, Fluorad FC-722 of Sumitomo 3M, Inc. are used, for example.

[0045] Thus, since all the PZT portions of an actuator 22 will also be covered by covering the

whole HGA by the covering film, degraining becomes that there is nothing. Since the fluorine system coating agent of FC-722 grade has ******, the migration by water absorption of a coating agent does not produce it under the environment of high temperature and high humidity.
[0046] Moreover, since it is covered to the electrode-terminal section of not only PZT but the actuator 22 and the head slider 21, improvement in reliability of connection can also be aimed at. In addition, since ABS of the head slider 21 is also covered simultaneously, contamination adhesion in ABS can also be prevented.
[0047] The structure of be [it / what is limited to the structure described above] of the suspension in HGA of this invention is clear. In addition, although not illustrated, you may equip with IC chip for a head drive in the middle of a suspension 20.
[0048] Drawing 4 is a flow chart for explaining 1 manufacture process of HGA in this operation gestalt.
[0049] First, the actuator 22 and the magnetic-head slider 21 like the above-mentioned are prepared (Step S1).
[0050] Adhesives are applied to jointing of tongue 26a of FUREKUSHA 26 of the suspension 20 (Step S2) prepared for the suspension side (Step S3).
[0051] Subsequently, attachment by the actuator 22 and the suspension is performed (step S4), after that, ultraviolet rays are irradiated, adhesives are stiffened to some extent, and temporary adhesion is performed (Step S5).
[0052] Subsequently, while applying and (Step S6) heating a silver paste into the portion which corresponds the terminal electrode of an actuator 22 to the connection pad formed in tongue 26a of FUREKUSHA 26 that it should connect and calcinating a silver paste, adhesives are made to heat-harden completely (Step S7).
[0053] Then, adhesives are applied on the root face of the actuator 22 in actuator-suspension ashy which carried out in this way and was assembled (Step S8).
[0054] Subsequently, on these actuator-suspension ashy, the magnetic-head slider 21 is attached, HGA is formed (step S9), after irradiating ultraviolet rays, stiffening adhesives to some extent and performing temporary adhesion (Step S10), it heats and adhesives are made to heat-harden completely further after that (Step S11).
[0055] Subsequently, processing which connects the terminal electrode of the magnetic-head slider 21 to the connection pad 29 in which it was prepared by the point of FUREKUSHA 26 is performed (Step S12).
[0056] Then, HGA which carried out in this way and was assembled is dipped in the solution of Fluorad FC-722 of for example, Sumitomo 3M, Inc. which is every round head and a fluorine system coating agent (Step S13). Specifically, although it is a mere example, it carries out being immersed (DIP) into the solution which dissolved and obtained FC-722 (2%) by PF5060 (98%) of Sumitomo 3M, Inc. which is a solvent.
[0057] Subsequently, HGA is pulled up and dried from this solution (Step S14). It is made, when this dryness puts in HGA in oven, for example, performs 120 degrees C and heat curing for about 30 minutes. Ultraviolet rays or infrared radiation may be irradiated and may be made to heat-harden.
[0058] Since the whole HGA is covered by the covering film and all the PZT portions of an actuator will also be covered by this, degraining becomes that there is nothing. Since the fluorine system coating agent of FC-722 grade has ******, the migration by water absorption of a coating agent does not produce it under the environment of high temperature and high humidity.
[0059] Moreover, since it is covered to the electrode-terminal section of not only PZT but the actuator 22 and the head slider 21, improvement in reliability of connection can also be aimed at. In addition, since ABS of the head slider 21 is also covered simultaneously, contamination adhesion in ABS can also be prevented. Furthermore, since the covering film by the fluorine system coating agent is formed in this whole HGA after forming HGA through processes, such as adhesion, a bond strength does not fall. And since coating of HGA can be performed only in a DIP, a manufacturing process can be simplified sharply.
[0060] Although the thickness of a wrap covering film can control the whole HGA by the concentration of the solution at the time of a DIP, the speed (thickness will generally become

thick if raising speed is quick, and it will become thin if late) when dipping and pulling up HGA from a DIP tub, DIP temperature, etc., if it becomes not much thick, the movement of an actuator 22 will be checked and a stroke (variation rate) will fall. Drawing 5 is drawing showing the fall property of the stroke to the thickness of a covering film. As shown in this drawing, without that it is 1.8nm or less filling the gap between each part material of HGA, from the point that thin layer coating can be performed, the thickness of a covering film is desirable and it is more desirable that it is 1.2nm or less.

[0061] In addition, as long as the solution into which HGA is made to dip is a low surface energy coating agent solution, without being limited to a fluorine system coating agent solution, it may be what thing.

[0062] Drawing 6 is a perspective diagram showing the whole HGA in other operation gestalten of this invention, and drawing 7 and drawing 8 are the perspective diagrams which looked at the point of HGA in the operation gestalt of drawing 6 from a mutually different direction. In addition, this operation gestalt is the case where a slider **** type thing is used, as an actuator.

[0063] As shown in drawing 6 - drawing 8 , HGA in this operation gestalt fixes the actuator 62 for performing precision positioning which is pinching the side of the magnetic-head slider 61 in which it has a magnetic-head element to the point of a suspension 60, and is constituted.

[0064] The main actuator 15 shown in drawing 1 is formed in order to carry out the variation rate of the drive arm 16 which attached HGA17 and to move the whole assembly, and with such a main actuator 15, this actuator 62 is formed in order to make possible the detailed variation rate which cannot be driven.

[0065] As shown in drawing 6 - drawing 8 , a suspension 60 The 1st and the 2nd load beam 63 and 64, The hinge 65 which has the elasticity which connects mutually these [1st] and the 2nd load beam 63 and 64, It mainly consists of FUREKUSHA 66 which has the elasticity by which fixing support was carried out on the 2nd load beam 64 and the hinge 65, and a circular base plate 67 formed at installation section 63a of the 1st load beam 63.

[0066] FUREKUSHA 66 has soft tongue 66a pressed by the dimple (with no illustration) prepared in the 2nd load beam 64 at one edge, and base 62a of an actuator 62 has fixed through insulating-layer 66b by the polyimide etc. on this tongue 66a. This FUREKUSHA 66 has the elasticity which supports the magnetic-head slider 61 flexibly through an actuator 62 by this tongue 66a. FUREKUSHA 66 is constituted from this operation gestalt by the stainless steel plate (for example, SUS304TA) with a thickness of about 20 micrometers. In addition, fixing with FUREKUSHA 66, the 2nd load beam 64, and a hinge 65 is made by pinpoint fixing with two or more welding points.

[0067] The hinge 65 has the elasticity for giving the force of suppressing a slider 61 in the direction of a magnetic disk through an actuator 62 with the 2nd load beam 64. This hinge 65 is constituted from this operation gestalt by the stainless steel plate with a thickness of about 40 micrometers.

[0068] With this operation gestalt, the 1st load beam 63 consists of stainless steel plates of about 100-micrometer **, and it goes across a hinge 65 all over the, and it is supporting it. However, fixing with the load beam 63 and a hinge 65 is made by pinpoint fixing with two or more welding points. Moreover, with this operation gestalt, the 2nd load beam 64 also consists of stainless steel plates of about 100-micrometer **, and has fixed in the edge to the hinge 65. However, fixing with the load beam 64 and a hinge 65 is also made by pinpoint fixing with two or more welding points. In addition, lift tab 64a for separating HGA from the magnetic-disk front face at the time of an inoperative is prepared at the nose of cam of this 2nd load beam 64.

[0069] With this operation gestalt, the base plate 67 consists of the stainless steel or iron of about 150-micrometer **, and has fixed by welding to installation section 63a of the base of the 1st load beam 63. This base plate 67 is attached in the drive arm 16 (drawing 1).

[0070] two or more leads depended on a laminating thin film pattern on FUREKUSHA 66 -- the flexible wiring containing a conductor -- the member 68 is formed or laid wiring -- the member 68 is formed on the sheet metal like FPC by the same well-known patterning method as creating a printed circuit board this wiring -- a member 68 is formed by carrying out the laminating of the 2nd insulating material layer by resin material, such as a polyimide with an insulating material

layer [by resin material, such as a polyimide with a thickness of about 5 micrometers, / 1st], a Cu layer (lead conductor layer) of with a thickness of about 4 micrometers patternized, and a thickness of about 5 micrometers, one by one from a FUREKUSHA 66 side in this sequence However, as for the portion of the connection pad for connecting with a magnetic-head element, an actuator, and an external circuit, laminating formation of the Au layer is carried out on Cu layer, and the insulating material layer is not formed on it.
[0071] this operation gestalt -- setting -- this wiring -- two one side and the both sides by which a member 68 is connected to a magnetic-head element -- the lead of a total of four -- the 1st wiring containing a conductor -- a member -- 68a, and one one side and the both sides which are connected to an actuator 62 -- the lead of a total of two -- the 2nd wiring containing a conductor -- it consists of member 68b
[0072] the 1st wiring -- a member -- the lead of 68a -- the end of a conductor is connected to the connection pad 69 for magnetic-head elements prepared on separation section 66c which is separated from this FUREKUSHA 66 and can carry out free movement in the point of FUREKUSHA 66 The connection pad 69 is connected to terminal electrode 61a of the magnetic-head slider 61 by golden bonding, wirebonding, or stitch bonding. the 1st wiring -- a member -- the lead of 68a -- the other end of a conductor is connected to the connection pad 70 for external circuits for connecting with an external circuit
[0073] the 2nd wiring -- a member -- the lead of 68b -- the end of a conductor is connected to the connection pad 71 for actuators formed on insulating-layer 66b of tongue 66a of FUREKUSHA 66, and this connection pad 71 is connected to A channels and the B channel signal terminal electrodes 62b and 62c which were prepared in base 62a of an actuator 62, respectively the 2nd wiring -- a member -- the lead of 68b -- the other end of a conductor is connected to the connection pad 70 for external circuits for connecting with an external circuit
[0074] The structure of be [it / what is limited to the structure described above] of the suspension in HGA of this invention is clear. In addition, although not illustrated, you may equip with IC chip for a head drive in the middle of a suspension 60.
[0075] Drawing 9 is the plan showing the structure of the actuator in this operation gestalt.
[0076] As shown in this drawing, one pair of movable arm sections 91 and 92 are perpendicularly extended from the ends of the base 90 (62a) where the flat-surface configuration fixes an actuator 62 to a suspension by having become abbreviation KO character-like. The slider fixing sections 93 and 94 which fix on the side of the magnetic-head slider 61 are formed in the point of the movable arm sections 91 and 92, respectively. The interval between the slider fixing section 93 and 94 is set up so that it may become a little smaller than the width of face of the magnetic-head slider which should ****. The thickness of an actuator 62 is set below to the thickness of the magnetic-head slider which should **** so that thickness of HGA may not be increased by actuator mounting. Conversely, if it says, the intensity of the actuator itself can be raised by enlarging by Mr. Atsushi of a magnetic-head slider who should **** thickness of an actuator 62, without increasing the thickness of HGA.
[0077] The slider fixing sections 93 and 94 are projected in the magnetic-head slider 61 direction, and only this portion fixes with the side of the magnetic-head slider 61, and they are made by this as [serve as / an opening / the remaining portion between the magnetic-head slider side and the movable arm sections 91 and 92].
[0078] the movable arm sections 91 and 92 -- respectively -- an arm -- Members 91a and 92a and these arms -- it consists of piezoelectric devices 91b and 92b formed in the side of Members 91a and 92a
[0079] a base 90 and an arm -- Members 91a and 92a are formed with the ceramic sintered compact 2 which has elasticity, for example, ZrO, in one Thus, it is high, i.e., the shock resistance of the actuator itself improves the principal part of an actuator by [which is rigidity] considering as the ceramic sintered compact of strong ZrO2 grade to bending.
[0080] Each of piezoelectric devices 91b and 92b has multilayer structure to which the laminating of the piezo-electricity and electrostriction material layer and signal-electrode layer which are expanded and contracted by the inverse piezoelectric effect or the electrostrictive effect, and the grand electrode layer was carried out by turns. The signal-electrode layer is

connected to A channels shown in drawing 7 and drawing 8 , B channel signal terminal electrode 62b, or 62c, and the grand electrode layer is connected to 62d of grand terminals, and 62e.
[0081] Piezo-electricity and the electrostriction material layer consist of so-called piezoelectric material, such as PZT, and polarization processing for the improvement in variability ability is usually performed. The direction of polarization by this polarization processing is the direction of a laminating of a piezoelectric device. When the sense of the electric field when impressing voltage to an electrode layer is in agreement with the direction of polarization, it elongates in the thickness direction (piezo-electric longitudinal effect), and the piezo-electricity and electrostriction material layer between two electrodes are contracted by the field inboard (piezo-electric transversal effect). On the other hand, when the sense of electric field is contrary to the direction of polarization, it contracts in the thickness direction (piezo-electric longitudinal effect), and piezo-electricity and an electrostriction material layer are elongated by the field inboard (piezo-electric transversal effect).
[0082] If the voltage which makes piezoelectric devices 91b and 92b produce contraction or extension is impressed, each piezoelectric-device portion contracts or develops each time, by this, each of the movable arm sections 91 and 92 will bend in the shape of S character, and the point will rock it linearly in a longitudinal direction. Consequently, the magnetic-head slider 61 is similarly rocked linearly in a longitudinal direction. Thus, since it is not angle rocking but straight-line rocking, high positioning of precision is attained from a magnetic-head element's.
[0083] You may impress simultaneously voltage which a reverse variation rate produces mutually to both piezoelectric devices. That is, when another side contracts to them when one side develops to one piezoelectric device and the piezoelectric device of another side, and one side contracts to them, you may impress simultaneously police box voltage which another side elongates. Rocking of the movable arm section at this time makes a center the position at the time of no voltage impressing. In this case, the amplitude of rocking when making driver voltage the same becomes the twice [about] in the case of impressing voltage by turns. However, in this case, by one rocking side, a piezoelectric device is made elongated and the driver voltage at this time becomes contrary to the sense of polarization. For this reason, when applied voltage is high, in performing voltage impression continuously, there is a possibility that polarization of piezo-electricity and electrostriction material may decline. Therefore, it is made for a bird clapper not to have the sense of driver voltage in the sense and reverse of polarization by applying fixed direct-current bias voltage to polarization and the same direction, and making into driver voltage what superimposed above-mentioned police box voltage on this bias voltage. Rocking in this case makes the position when impressing only bias voltage a center.
[0084] In addition, piezo-electricity and electrostriction material mean the material expanded and contracted by the inverse piezoelectric effect or the electrostrictive effect. Although piezo-electricity and electrostriction material may be anything as long as it is a material applicable to the movable arm section of an actuator which was mentioned above, its ceramic piezo-electricity and electrostriction material, such as PZT [Pb(Zr, Ti) O3], PT (PbTiO3), PLZT [(Pb, La) (Zr, Ti)O3], and a barium titanate (BaTiO3), are usually desirable from rigidity being high.
[0085] Although the important point is not shown in drawing in this operation gestalt, the whole HGA is covered by the covering film by the low surface energy coating agent which is for example, a fluorine system coating agent. As a fluorine system coating agent, Fluorad FC-722 of Sumitomo 3M, Inc. are used, for example.
[0086] Thus, since all the PZT portions of an actuator 62 will also be covered by covering the whole HGA by the covering film, degraining becomes that there is nothing. Since the fluorine system coating agent of FC-722 grade has ******, the migration by water absorption of a coating agent does not produce it under the environment of high temperature and high humidity.
[0087] Moreover, since it is covered to the electrode-terminal section of not only PZT but the actuator 62 and the head slider 61, improvement in reliability of connection can also be aimed at. In addition, since ABS of the head slider 61 is also covered simultaneously, contamination adhesion in ABS can also be prevented.
[0088] The structure of be [it / what is limited to the structure described above] of the suspension in HGA of this invention is clear. In addition, although not illustrated, you may equip

with IC chip for a head drive in the middle of a suspension 60.
[0089] Drawing 10 is a flow chart for explaining 1 manufacture process of HGA in this operation gestalt.
[0090] First, the actuator 62 like the above-mentioned is prepared (Step S101).
[0091] Adhesives are applied to the both-sides side of the magnetic-head slider 61 (Step S102) prepared for the magnetic-head slider 61 side (Step S103).
[0092] Subsequently, this magnetic-head slider 61 is inserted between the movable arm section 91 of the actuator 62 currently similarly laid on the plate, and 92 (Step S104), after that, ultraviolet rays are irradiated, adhesives are stiffened to some extent, and temporary adhesion is performed (Step S105). In addition, if it sets up so that the interval between the slider fixing section 93 in the movable arm sections 91 and 92 of an actuator 62 and 94 may become a little smaller than the width of face of the magnetic-head slider 61, temporary fixation of the magnetic-head slider 61 will be carried out by the retention span of the movable arm sections 91 and 92, without using a electrode holder etc.
[0093] Subsequently, it heats and adhesives are made to heat-harden completely (Step S106). Thereby, slider-actuator ashy which is the complex of the magnetic-head slider 61 and an actuator 62 is formed.
[0094] On the other hand, a suspension which was mentioned above is prepared (Step S107), adhesives are applied on separation section 66c of FUREKUSHA 66, respectively the insulating-layer 66b top in tongue 66a of the FUREKUSHA 66 (Step S108), and adhesion fixation of slider-actuator ashy is carried out on a suspension. Thereby, attachment by the slider-actuator ashy suspension is performed and HGA is formed (Step S109).
[0095] Subsequently, after irradiating ultraviolet rays, stiffening adhesives to some extent and performing temporary adhesion (Step S110), it heats and adhesives are made to heat-harden completely further (Step S111).
[0096] Subsequently, processing which connects the terminal electrode of the magnetic-head slider 61 and an actuator 62 to a connection pad is performed (Step S112).
[0097] Then, HGA which carried out in this way and was assembled is dipped in the solution of Fluorad FC-722 of for example, Sumitomo 3M, Inc. which is every round head and a fluorine system coating agent (Step S113). Specifically, although it is a mere example, it carries out being immersed (DIP) into the solution which dissolved and obtained FC-722 (2%) by PF5060 (98%) of Sumitomo 3M, Inc. which is a solvent.
[0098] Subsequently, HGA is pulled up and dried from this solution (Step S114). It is made, when this dryness puts in HGA in oven, for example, performs 120 degrees C and heat curing for about 30 minutes. Ultraviolet rays or infrared radiation may be irradiated and may be made to heat-harden.
[0099] Since the whole HGA is covered by the covering film and all the PZT portions of an actuator will also be covered by this, degraining becomes that there is nothing. Since the fluorine system coating agent of FC-722 grade has ******, the migration by water absorption of a coating agent does not produce it under the environment of high temperature and high humidity.
[0100] Moreover, since it is covered to the electrode-terminal section of not only PZT but the actuator 62 and the head slider 61, improvement in reliability of connection can also be aimed at. In addition, since ABS of the head slider 61 is also covered simultaneously, contamination adhesion in ABS can also be prevented. Furthermore, since the covering film by the fluorine system coating agent is formed in this whole HGA after forming HGA through processes, such as adhesion, a bond strength does not fall. And since coating of HGA can be performed only in a DIP, a manufacturing process can be simplified sharply.
[0101] Without that it is 1.8nm or less filling the gap between each part material of HGA like the case of the operation gestalt of drawing 1 , if the whole HGA is attached to the thickness of a wrap covering film, from the point that thin layer coating can be performed, it is desirable and it is more desirable that it is 1.2nm or less.
[0102] In addition, as long as the solution into which HGA is made to dip is a low surface energy coating agent solution, without being limited to a fluorine system coating agent solution, it may be what thing.

[0103] Since the other composition and operation effects of this operation gestalt are completely the same as that of the case of the operation gestalt of drawing 1 , explanation is omitted.
[0104] As mentioned above, although this invention was explained using HGA equipped with the actuator for minute positioning of a thin film magnetic-head element, this invention is not limited only to HGA equipped with such an actuator, and can be applied also to HGA equipped with the actuator for minute positioning of head elements other than a thin film magnetic-head element (for example, an optical head element etc.).
[0105] this invention cannot be shown in instantiation, and not all the operation forms described above can show it in limitation, and can carry out this invention in other various deformation modes and change modes. Therefore, the range of this invention is prescribed by only a claim and its equal range.
[0106]
[Effect of the Invention] Since the whole HGA is covered by the covering film by the low surface energy coating agent which is for example, a fluorine system coating agent according to this invention as explained to the detail above and all the piezoelectric-material portions of an actuator will also be covered, degraining becomes that there is nothing. Since a low surface energy coating agent has ******, the migration by water absorption of a coating agent does not produce it under the environment of high temperature and high humidity.
[0107] Moreover, since it is covered to the electrode-terminal section of not only piezoelectric material but an actuator and a head slider, improvement in reliability of connection can also be aimed at. In addition, since the surfacing side (ABS) of a head slider is also covered simultaneously, contamination adhesion in ABS can also be prevented.
[0108] Furthermore, since the covering film by the low surface energy coating agent which is for example, a fluorine system coating agent is formed in this whole HGA after forming HGA (i.e., since it has coated after adhesion), a bond strength does not fall.
[0109] If HGA is dried after being immersed in the low surface energy coating agent solution which is for example, a fluorine system coating agent, and formation of a covering film is performed, since thin layer coating can be performed without filling the gap between each part material of HGA, operation of an actuator is not checked. And since coating of HGA can be performed only in being immersed, a manufacturing process can be simplified sharply.

[Translation done.]

* NOTICES *

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damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] As 1 operation gestalt of this invention, it is the perspective diagram showing the composition of the important section of a magnetic disk unit roughly.
[Drawing 2] It is the plan which looked at the whole head suspension assembly in the operation gestalt of drawing 1 from the slider side.
[Drawing 3] It is the decomposition perspective diagram showing the installation structure to FUREKUSHA of the actuator in the operation gestalt of drawing 1 , and a magnetic-head slider.
[Drawing 4] It is a flow chart for explaining 1 manufacture process of HGA in the operation gestalt of drawing 1 .
[Drawing 5] It is drawing showing the fall property of the stroke to the thickness of a covering film.
[Drawing 6] It is a perspective diagram showing the whole HGA in other operation gestalten of this invention.
[Drawing 7] It is the perspective diagram of the point of HGA in the operation gestalt of drawing 6 .
[Drawing 8] It is the perspective diagram which looked at the point of HGA in the operation gestalt of drawing 6 from the direction where drawing 3 differs.
[Drawing 9] It is the plan showing the structure of the actuator in the operation gestalt of drawing 6 .
[Drawing 10] It is a flow chart for explaining 1 manufacture process of HGA in the operation gestalt of drawing 6 .
[Description of Notations]
10 Magnetic Disk
11 13 Shaft
12 Assembly Carriage Equipment
14 Carriage
15 The Main Actuator
16 Drive Arm
17 HGA
20 60 Suspension
21 61 Magnetic-head slider
21a Predetermined section
21b Magnetic-head element
22 62 Actuator
22a Fixed part
22b Moving part
22c, 22d Displacement generating arm section
23 Load Beam
23a, 63a Installation section
26 66 FUREKUSHA
26a, 66a Tongue

27 67 Base plate
28 and 68 wiring -- member
28a and 68a the 1st wiring -- member
28b and 68b the 2nd wiring -- member
29 69 Connection pad for magnetic-head elements
30 70 Connection pad for external circuits
61a Terminal electrode
62a, 90 Base
62b, 62c Signal terminal electrode
62d, 62e Grand terminal electrode
63 1st Load Beam
64 2nd Load Beam
64a Lift tab
65 Hinge
66b Insulating layer
66c Separation section
71 Connection Pad for Actuators
91 92 Movable arm section
91a and 92a an arm -- member
91b, 92b Piezoelectric device
93 94 Slider fixing section

[Translation done.]